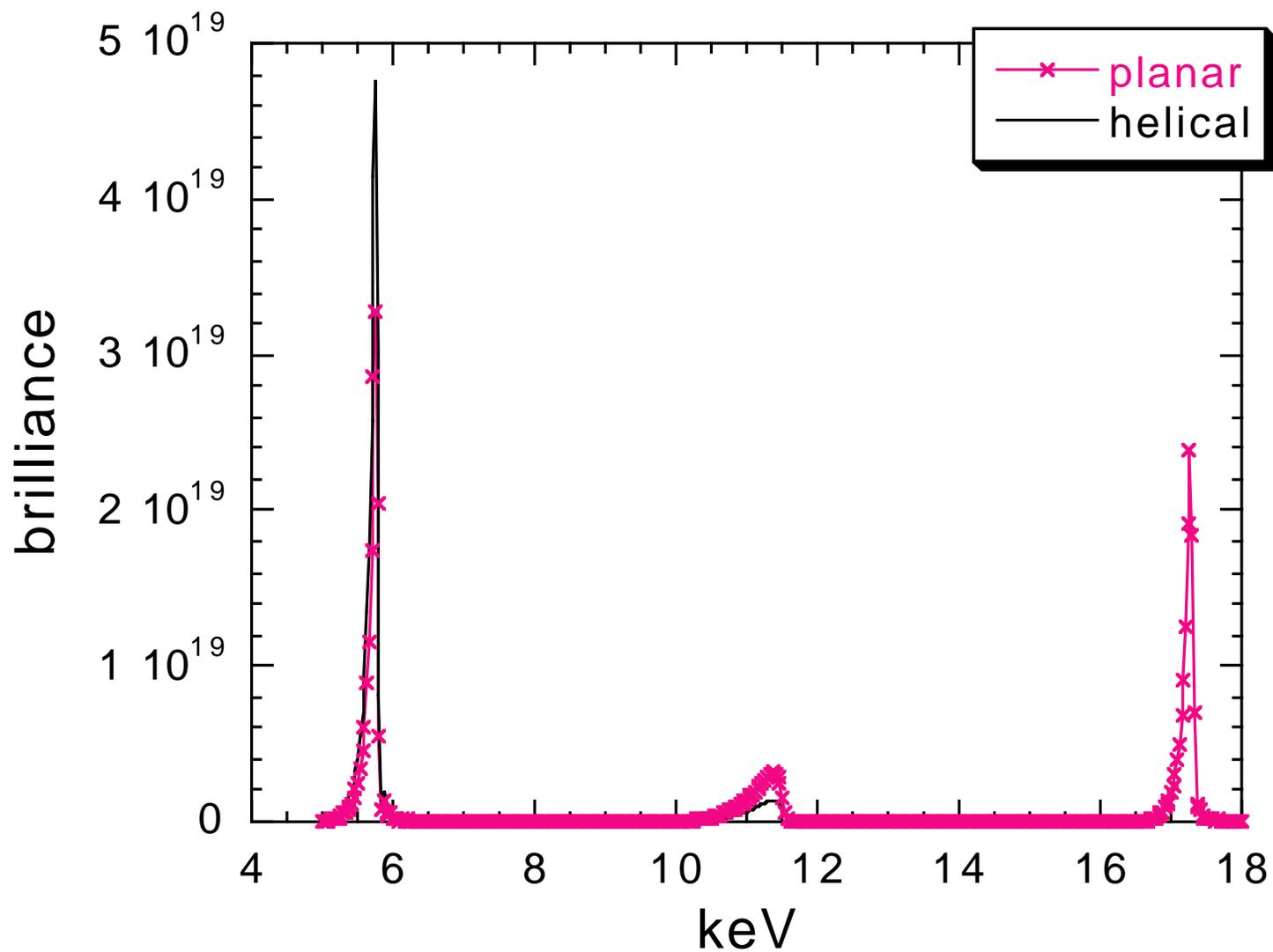


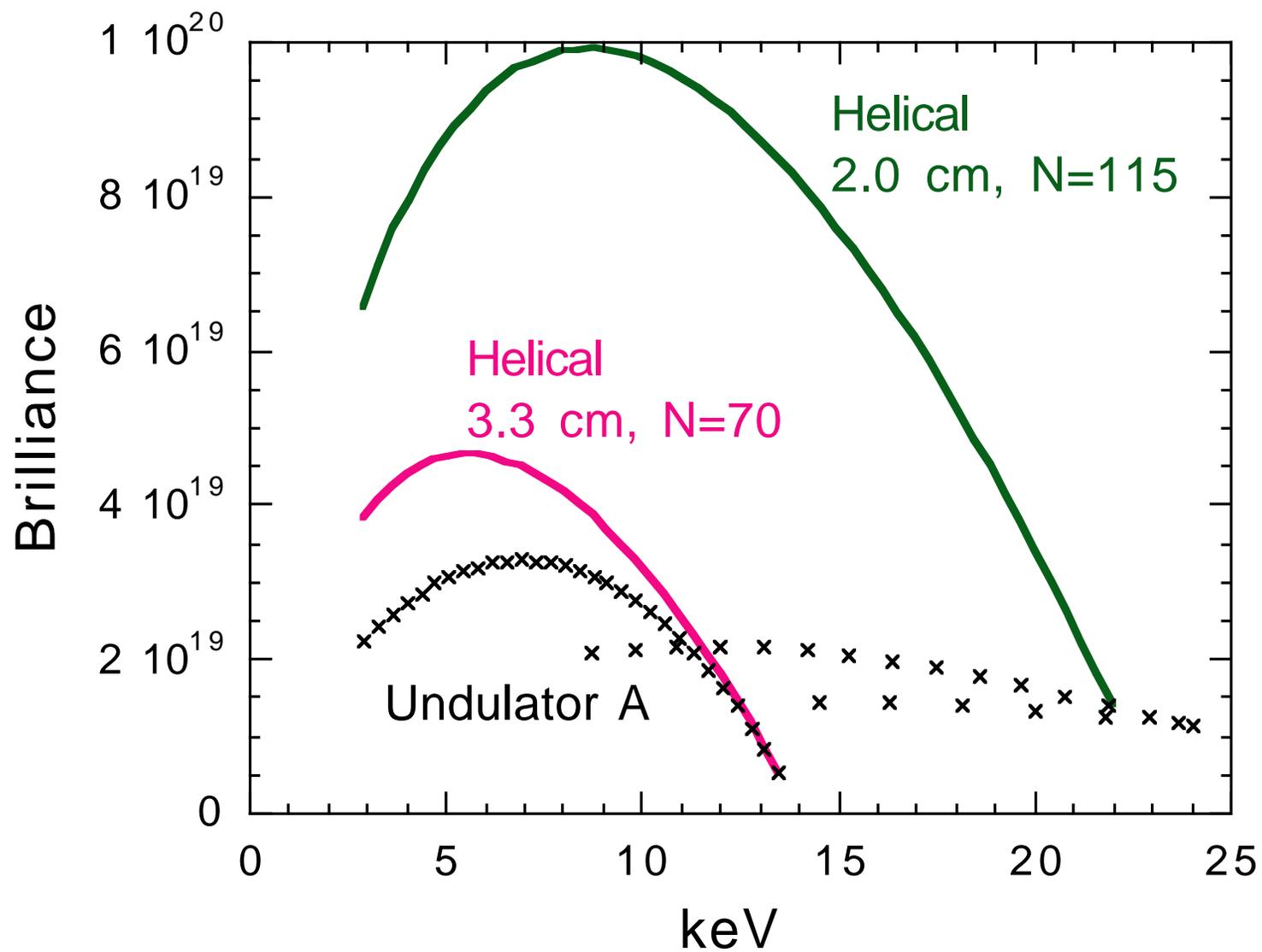
**Helical Undulators: Higher Brilliance Without
Paying the Price of Higher Thermal Load**

Barry Lai (XFD)

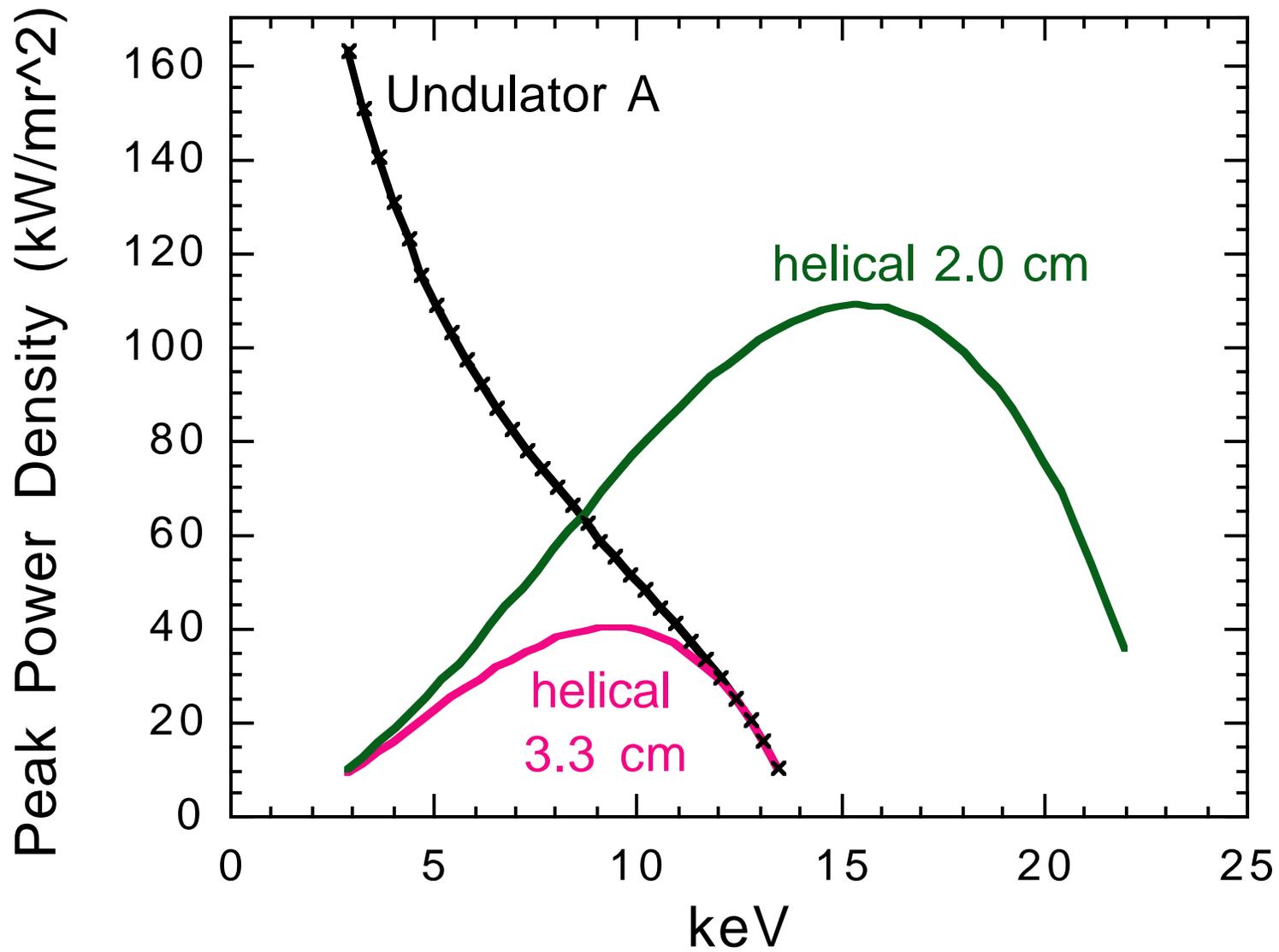
Helical vs Planar Undulator (period=3.3 cm, N=70)



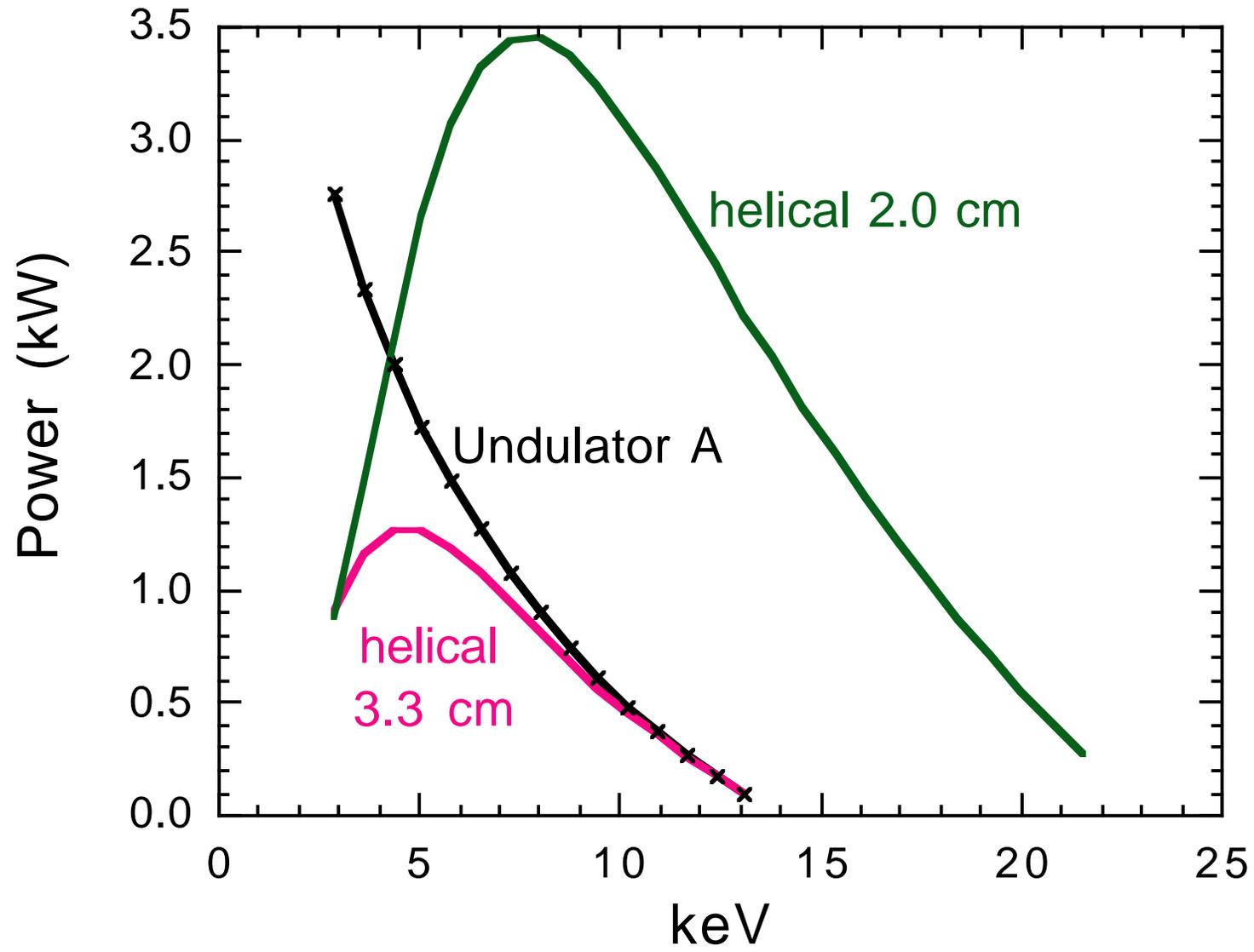
Tuning Curve (3.5 nm-rad, 1% coupling, 100 mA)



Peak Power Density



Power thru 4.5x4.5mm fixed mask @ 25m



A 3.3 cm Helical Undulator Has Much Higher Benefits/Cost, than higher ring current:

1. Higher brilliance (x1.4)
2. Reduce power density (x4) and total power (x2)
3. Harmonic rejection
4. Adjustable polarization for free (linear, circular, elliptical)
5. Can always turn back to a planar undulator

	<u>Undulator A</u>	<u>Helical 3.3 cm</u>	<u>Helical 2.0 cm</u>
Brilliance	3.3×10^{19}	4.7×10^{19}	9.9×10^{19}
Max. Power Density (kW/mr ²)	163	40	109
Power thru Fixed Mask (kW)	2.8	1.3	3.4

Figure of Merit = Brilliance/Thermal load:

1. = 3.0-5.8, helical undulator, 3.3 cm
2. = 2.4-4.5, helical undulator, 2.0 cm
3. = 1.0, raising storage ring current
4. = 2.0, reducing horizontal emittance by 2
5. = 1.0, reducing vertical emittance by 2

What about upgrade cost per sector?

Helical undulator \approx \$1M

Accelerator Components + Front End + Beamline Optics \approx \$2-5M

10-m long helical undulator (2.0 cm, N=500)
+ no monochromator = gain of 1,000 in useful flux

